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Soviet Air and Missile Defense Capabilities Through Mid-1970

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The following intelligence organizations participated in the preparation of this estimate:

The Central Intelligence Agency and the intelligence organizations of the Departments of State, Defense, AEC, and NSA.

Concurring:

Director of Intelligence and Research, Department of State

Director, Defense Intelligence Agency

The Atomic Energy Commission Representative to the USIB

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SOVIET AIR AND MISSILE DEFENSE CAPABILITIES THROUGH MID-1970

THE PROBLEM

To evaluate the capabilities of the Soviet air and missile defense forces, and to forecast probable trends in Soviet air and missile defense programs through mid-1970.

CONCLUSIONS

A. The combination of area and point defenses provided by the USSR's present force of interceptors and short-range surface-to-air missile (SAM) systems affords a good defense for major target areas against medium and high altitude bomber attacks. However, the air defense system has limited low altitude capabilities, and special difficulties are posed by supersonic aircraft and air-to-surface missiles (ASMs). We believe that a major Soviet effort during the remainder of this decade will be focused on meeting these particular problems. (*Para. 55*)

B. We believe that improvements in the Soviet air defense system over the next few years will make progressively more difficult successful penetration by manned bombers to major target areas. Successful penetration by manned bombers will require increasingly sophisticated forms of attack. Soviet air defense capabilities can be degraded by the increasingly complex forms of attack which the West will be able to employ, including air-launched missiles, penetration tactics, electronic countermeasures, and low-altitude attack. Despite these limitations of their air defense system, the Soviets would expect to destroy a number of the attackers. We doubt, however, that they would be confident that they could reduce the weight of attack to a point where the resulting damage to the USSR would be acceptable. (*Para. 57*)

C. There are critical uncertainties in our knowledge of Soviet R&D and deployment in the antiballistic missile (ABM) field. From the evidence now available, however, certain general conclusions can be drawn: first, the Soviet R&D effort has been extensive and of long duration, and the USSR several years ago probably solved the technical problem of intercepting ballistic targets arriving singly or in small numbers; second, some initial ABM deployment activity was probably begun as long ago as 1960, but both the deployment and R&D programs were evidently interrupted and modified; third, the magnitude of R&D and the probable early deployment activity point to a strong Soviet desire to obtain ABM defenses rapidly; fourth, R&D continues, a new antimissile missile (AMM) has appeared, and some additional deployment activity may now be underway, but the USSR does not have any operational defenses against strategic ballistic missiles today. (*Para. 58*)

D. Much of our evidence indicates that the USSR has been exploring methods of ABM defense which differ in important respects from those now favored by the US. Low frequency radars may play an important role in the Soviet program. An early Soviet effort may have involved a missile designed to have dual capabilities against ballistic and aerodynamic vehicles. The new AMM which was recently displayed by the Soviets is probably designed to conduct exoatmospheric intercepts at considerable ranges, using a large nuclear warhead to achieve its kill. We believe, however, that the Soviets have probably not conducted many AMM firings to exoatmospheric altitudes, and that they have probably not attempted full system tests involving interceptions at these altitudes. (*Paras. 37-42, 59*)

Recent Defensive Deployments

E. The Soviets began construction of three defensive complexes at Leningrad in 1960-1961. We believe that the Leningrad system was originally designed to have a capability against ballistic missiles, and perhaps against aerodynamic vehicles as well. However, we believe that the initial design has been changed. We cannot determine the nature of this change, or whether it was caused by serious technical difficulties, a realization that the system was vulnerable to penetration aids, or important new developments in the state-of-the art. There are similarities between new construction at one of the Leningrad complexes and two recently discovered defensive complexes un-

der construction in northwestern USSR. In light of these similarities, at least these three complexes may now be intended for the deployment of the same defensive system. (*Paras. 46-47*)

F. We are unable to associate the new complexes with any systems equipment, and any explanation for the mission of these complexes and the modified Leningrad complex is open to some doubt. There is some support for the belief that the complexes are for a SAM system to defend against aerodynamic vehicles. On the other hand, we have noted intensive Soviet research on missile defenses for several years and indications that the USSR has been working toward new and different ABM capabilities. In light of this factor and other considerations, we think there are also persuasive reasons for believing that the new complexes are related to missile defense. However, any judgment at this time on their mission is in our view premature. (*Paras. 47, 50*)

G. We have observed at Moscow three developments which may indicate ABM deployment there. A large radar now under construction could be the acquisition and early target tracking element of an ABM system. Other facilities also under construction could serve as the final target tracking and missile guidance element. SA-1 sites which are now being modified could be used as the AMM launch positions for the systems. However, the activities we have observed thus far may not be related, and some of them may represent improvements in Moscow's defense against aerodynamic vehicles or serve a space function. The missile to be employed is a major unknown; the recently displayed AMM could be used at Moscow to conduct exoatmospheric intercepts of ballistic missiles, perhaps at distances of several hundreds of miles from the city. In sum, we continue to believe that the Soviets may be deploying ABM defenses at Moscow, but we do not yet understand how the installations we have observed would function as an ABM system. (*Paras. 41, 51-54*)

ABM Prospects

H. If ABM deployment activity is now underway at either Moscow or the other locations we have noted, the USSR is likely to have some initial strategic ABM defenses operational within the next two years or so. Limited deployment, especially at Moscow, could be a special, highest-priority effort to defend the Soviet capital with an early and still unproved system. But widespread ABM deployment activity, whenever it occurred, would imply that the Soviets consider their ABM

systems good enough to justify extraordinarily large new expenditures. It would indicate that the Soviets had achieved excellent R&D successes, and perhaps, that they had taken high-risk production and deployment decisions. We cannot exclude this possibility, but our evidence suggests that the Soviets have been proceeding cautiously since they modified their program. (*Paras. 60-61*)

I. In considering whether to provide ABM defenses for many of their urban-industrial centers and other targets, the Soviet leaders will have to weigh the great cost of such an effort against the likely effectiveness of the ABM systems available. Area defenses might offer considerable savings over point defenses, but we cannot be sure of this and in any event a major commitment of resources would be required. The Soviets may defer widespread deployment pending further R&D work on existing systems, or in the hope of achieving better systems at a later date. They might even decide that the cost of large-scale ABM deployment would not be commensurate with the protection it could offer against anticipated Western strike capabilities. We are certain that the Soviets will push ahead with their R&D effort, but we cannot forecast whether or when they will achieve ABM systems with capabilities and costs justifying widespread deployment. (*Para. 62*)

Antisatellite Capabilities

J. We believe that the Soviets are now constructing a series of large, new radars, most of which will probably be completed in 1966. We believe that some or all of these radars will be linked together as a space surveillance system. Such a system will, we think, have a capability considerably in excess of that required merely to detect the passage of US space vehicles. In our view, the chances are better than even that the Soviets intend to provide themselves, not only with a space surveillance system, but with an antisatellite capability as well.[1] If existing types of missiles were used in an antisatellite system, a nuclear warhead would probably be required, but a missile for non-nuclear kill could be developed in about two years after flight tests began. (*Paras. 63-66*)

[1] The Director of Intelligence and Research, Department of State, believes that on the basis of available evidence, this affirmative judgment is premature. While he does not exclude the antisatellite function as a possibility, present evidence does not persuade him that the Soviets intend to develop and deploy within the next two years and at great cost an extremely complex antisatellite system.

DISCUSSION

I. INTRODUCTION

1. Since the end of World War II, the Soviets, confronted by large and powerful US strategic attack forces, have steadily increased and improved their air defenses. They have achieved a formidable capability against aircraft attempting to penetrate at medium and high altitudes to principal target areas. However US development of standoff weapons and low-altitude penetration tactics for aircraft have further complicated the Soviet air defense problem. We expect, therefore, that the Soviets will continue to spend large sums on air defense despite the planned decrease in the size of the US strategic bomber force over the next few years.

2. In addition, the Soviets have been faced for some years with the certain knowledge that as this decade advances, ballistic missiles, presenting wholly new defensive requirements, will comprise the main strategic threat to the USSR. The ballistic missile threat not only poses the question of how much additional effort to pour into improved defenses, but also raises the problem of whether, regardless of resources committed, it is feasible for the Soviets to create an effective defense of major targets against the US strategic strike forces.

II. ORGANIZATION OF AIR AND MISSILE DEFENSES

3. The Soviet air defense mission is the responsibility of the PVO Strany (Anti-Air Defense of the Nation), whose commander-in-chief, a Deputy Minister of Defense, is ranked with the heads of the ground, naval, air and strategic missile forces. The PVO is composed of three major elements, each of which performs one of the key functions of the air defense mission, i.e., early warning and control, interceptor, and surface-to-air missile (SAM) operations. In addition to forces directly assigned to the PVO, other Soviet forces which can contribute to the air defense mission are also operationally available to this command.

4. In addition to air defense, the commander of the PVO probably is assigned the missile defense mission. The Soviets have referred to the existence of PRO (Anti-Rocket Defense) units, and have usually indicated that these units are subordinate to, or at least integrated with, the PVO Strany. The Ministry of Defense implements the civil defense program, but such operations are not subordinate to the PVO.

5. The air defense systems of the several Warsaw Pact countries are separate national systems. Nevertheless, they are coordinated one with another, and for most practical purposes they constitute an extension of the Soviet system itself.[2] The Soviets undoubtedly will continue their policy of improving the air defense capabilities of these countries. Although the Chinese Communist air defense

[2] For details of SAM deployment in the Warsaw Pact countries, see Annex B, Maps 1 and 2.

system still maintains some contact with the PVO, cooperation between them has long been limited to the exchange of routine air information. In our view, it is unlikely that cooperation between the PVO and the Chinese air defense system will be increased during the next several years.

III. AIR DEFENSE EARLY WARNING AND GROUND CONTROLLED INTERCEPT SYSTEMS

6. The Soviets have continued during the past two years to deploy early warning (EW) and ground controlled intercept (GCI) radars and to maintain a large number of radar sites. We estimate that there are now over 5,000 radars deployed at some 1,400 operational sites in the USSR. This system provides overlapping radar coverage of most of the nation; coverage is very dense west of the Urals and in peripheral areas. Almost all sites have at least two radars and many are equipped with five to seven sets, most of which operate in different frequency bands. The resulting density of coverage heightens the probability of detection, and the frequency diversification provides some defense against electronic countermeasures.

Early Warning

7. The altitude coverage of the Soviet EW system exceeds the combat ceiling of any US aircraft now in service. Under optimum conditions, the Soviet EW system could detect and track aircraft flying at medium or high altitudes at least 200 n.m. away from Soviet territory, and under normal conditions detection and tracking of enemy aircraft flying at such altitudes is virtually assured about 135 n.m. beyond the Soviet borders. The use of supersonic aircraft and cruise missiles, because of their very high speeds, will reduce the warning time provided by this system. The detection range of the EW system is progressively reduced against aircraft penetrating at lower altitudes. Moreover, even where detection of low altitude penetrators occurs, the system is unlikely to be able to accomplish continuous tracking of an intruding enemy aircraft below 3,000 feet.

8. As the Soviet EW system improves in quality, the number of radar sites probably will be gradually reduced. We estimate that by 1970 the range performance of the Soviet EW system will be limited only by the radar horizon line of sight. The Soviets will place increased emphasis on the problem of detecting and tracking low altitude targets. Radars better able to cope with such targets probably will be deployed, particularly in border areas and along likely penetration routes. Nevertheless, radar performance at low altitudes will remain limited.

Ground Controlled Intercept

9. About one-third of the Soviet radar sites are capable of conducting GCI operations. Against targets flying at medium and high altitudes, we estimate

that GCI range capabilities vary from about 85 n.m. to about 200 n.m. depending on the radar employed at the site. Soviet GCI sets have a high altitude coverage which exceeds the combat ceilings of all US aircraft. We believe most GCI sites are equipped with radars having moving target indicators or employing anticlutter techniques in order to improve low altitude coverage. The Soviets probably would have great difficulty in conducting effective GCI operations against enemy aircraft flying below 3,000 feet. In addition, Soviet GCI capabilities against supersonic targets are generally reduced.

10. The Soviets have been improving their air defense control capabilities in recent years by deploying a semiautomatic data transmission system in the western USSR and to a lesser extent in other areas. This system is used for the rapid dissemination of tracking information from radar sites to air warning centers and probably to SAM units. Such a system would provide a major input to a ground-to-air data link designed to vector interceptors. We believe that the newer model all-weather interceptors are equipped with a data link system.

11. The Soviets will continue to develop their GCI capabilities during the period of this estimate. An improved GCI radar probably will be deployed during the period of this estimate, possibly in combination with a new EW set. The semiautomatic data system may be modified to increase traffic handling capabilities. All new model interceptors brought into service probably will be equipped to operate with the data link.

IV. INTERCEPTOR AIRCRAFT SYSTEMS

12. In the Soviet air defense system, interceptor aircraft constitute the first line of active defense, performing both area and point defense roles. We believe that during the past two years, the Soviets have been placing greater emphasis on improving the mobility and coverage of their interceptor force, especially through the use of forward deployment tactics. Air defense training has probably included the dispersal and redeployment of PVO aircraft.

Current Forces

13. We estimate that there now are some 3,800 to 4,000 PVO interceptors in operational service. Only about 20 percent of these are Mach 2 models and slightly more than a third of the force is equipped for all-weather operations. In addition to the PVO interceptor force, the fighters assigned to Tactical Aviation units also can be used in the air defense mission. We estimate that there are roughly 2,500 fighters now in service with Tactical Aviation, the majority of them deployed in western USSR and in those European Satellites where Soviet forces are stationed. Most of these fighters are not equipped for all-weather operations, and slightly less than half of the force is composed of Mach 2 aircraft. The fighters of Tactical Aviation, particularly the all-weather models, add a significant potential to Soviet air defense capabilities.

14. The Soviets now have in operational service some eight interceptor models, some of which have been deployed in as many as five different variations.[3] These aircraft can engage Western subsonic bombers attacking at medium or high altitudes, though most of the Soviet fighters and interceptors are limited by their radar and armament to tail attack tactics and are not capable of all-weather operations. About a third are equipped with air-to-air missiles (AAMs). New all-weather models, some of which now are entering service, have improved AAMs and fire control systems.

15. The introduction of newer model interceptors has been relatively slow, probably reflecting the greater complexity and cost of these weapons systems and possibly Soviet difficulty in perfecting them. The Soviets first displayed the Firebar, Fiddler, and Flipper interceptors in 1961. We believe that they began this year to deploy the all-weather Firebar and possibly another new model interceptor. The Firebar is believed to be capable of performing radar intercepts as low as about 1,000 feet. The Fiddler has a greater combat radius than any operational Soviet interceptor and, with its improved fire control system, it probably can attack airborne targets from any angle. The Fiddler probably is in the late stages of development; we have no firm evidence that it has been operationally deployed.

Prospects

16. The Soviets will continue to conduct research and development on manned interceptor aircraft. We believe that two or possibly three new interceptors are currently under development. A new all-weather interceptor with a speed of about Mach 2.5 and a combat radius of about 300 n.m. may be operational by mid-1966. The Soviets may also be developing an advanced all-weather interceptor with greater speed and combat radius, for deployment toward the end of the period of this estimate. In addition, new airborne intercept radars with a low altitude capability may become available by the end of the decade.

17. The introduction of newer aircraft will probably continue to be relatively slow. By 1970, the PVO interceptor force will probably be reduced to about 1,500 to 2,500 aircraft, more than two-thirds of which will probably be Mach 2, all-weather interceptors.[4] Tactical Aviation fighters will continue to add a significant potential to Soviet air defense capabilities. The capabilities of both these forces will increase because of the improved performance of the aircraft and the wider use of AAMs and semiautomatic control systems. We also estimate that the Soviets will arm some of their AAMs with nuclear warheads.

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[3] For performance characteristics of Soviet interceptor weapons systems, see Annex A, Table 1.

[4] The Assistant Chief of Staff, Intelligence, USAF, considers that the estimate projects a far-too-precipitous decline in IA PVO fighter strength. He notes that the estimated cut back of between 34 and 62 percent from present strength levels during the next five years represents a rate of reduction more than double what has occurred since 1961. He estimates that by mid-1970 the IA PVO still will include more than 3,000 interceptor aircraft.

V. SURFACE-TO-AIR MISSILE SYSTEMS

The SA-1

18. The SA-1 system, which has been observed only at Moscow, is densely deployed at 56 sites in a double ring around the city.[5] Installed in the period 1954 to 1958, it was probably intended as a defense against mass air raids. With the changed nature of the threat and the age of the system, we believe that the Soviets will phase out the SA-1. Retirement of the SA-1 almost certainly will be compensated for by additional SAM deployment at Moscow.

The SA-2

19. The great bulk of the Soviet SAM defenses consist of SA-2 sites, which are deployed around most urban areas of over 200,000 population and at the majority of the more important military installations.[6] This system, which became operational in about 1958, has also been deployed in barrier defense patterns in some border areas. We believe there are now more than 1,000 sites in the USSR, and that deployment of this system is continuing. The present defense patterns lead us to estimate that the Soviet force goal is some 1,100-1,200 sites, and we believe that this total will be deployed by the end of 1965.

20. The Soviets are likely to continue to rely on the SA-2 as the principal SAM system for air defense during the period of this estimate. They have modified the system several times, and they will probably continue to do so, but they are not likely to replace it completely with a follow-on system. The most recent modifications, made during the past year, were probably designed primarily to increase its range and improve its capabilities against supersonic targets. The Soviets almost certainly will provide some of their SA-2 sites with nuclear weapons, and may have begun to do so.

21. Past evidence has shown that the low altitude capability of the SA-2 system has been limited to about 3,000 feet. Recent evidence indicates that there are modifications which can be made to reduce the lower altitude limitation to about 1,500 feet. Additional recent data indicate that the Soviets are willing to commit missiles against targets flying considerably below 3,000 feet. At these low altitudes, the effectiveness of the system may be degraded; the low altitude limit of a given site would be affected by local terrain and other factors.

The SA-3

22. During the past year, the Soviets have continued to deploy the SA-3 system at a relatively slow pace; we believe only about 100 sites have been deployed since the program began in 1961. We estimate that this system was designed to cope with low-altitude attacks, i.e., at about 1,000 feet, although we have no evidence as to its actual minimum effective altitude. With few

[5] For performance characteristics of SAM systems, see Annex A, Table 2.

[6] For details of SAM deployment, see Annex B, Map 3.

exceptions, SA-3 sites have been deployed in the border areas most vulnerable to low-altitude attack. The SA-3 program thus far has been unusually small even as a low-altitude supplement to existing defenses. Considering the rate and pattern of deployment to date, and if the program continues in this fashion, we estimate that SA-3 deployment will total some 175-250 sites in 1966 or 1967.

23. The slow and limited deployment of the SA-3 may indicate that the Soviets are not fully satisfied with its capabilities. While we have no evidence of a follow-on low-altitude system, the Soviets may improve the SA-3 or develop a new system later in the period of this estimate. If they do so, we believe that there would be a more extensive deployment of low-altitude SAMs. However, a Soviet attempt to defend all key targets fully against low-altitude attack is probably precluded by the cost of the massive deployment which would be required.

Tactical Systems

24. We estimate that about 30 SA-2 sites now are deployed in defense of Soviet field forces in Eastern Europe.[7] We believe that these sites would be used to defend against the initial stages of a strategic air attack. In addition, the Soviets may have begun in the past year or so to issue a mobile SAM system to ground force units. This system may employ the trackmounted ram jet missile which has been displayed in Moscow. We have little evidence of the performance characteristics of this system, but as a field force SAM system it is not likely to be fully integrated into the air defense battle plan of the PVO. Similarly, when in port the Soviet destroyers and destroyer escorts equipped with SAMs probably would be employed as a supplement to port air defenses in the event of a strategic attack.

VI. AIR DEFENSE ELECTRONIC WARFARE CAPABILITIES

25. The Soviets expect that their air defense system will have to contend with electronic countermeasures (ECM). The density of EW/GCI radar sites, the frequency diversification at these sites, and the probable use of microwave links and coaxial cables all reduce the vulnerability of the Soviet air defense system to ECM. The Soviets may employ frequency diversification in their semiautomatic data transmission systems. In addition, the Soviets have used increased power to overcome ECM and have been experimenting with other techniques. The Soviets have placed great emphasis on training radar crews in operations in the presence of ECM. The SA-2 is designed to operate in an ECM environment. However, the Soviet air defense system still can be degraded by a combination of ECM and tactics.

26. The Soviets now have a good capability for jamming long-range radio communications and the navigational and bombing radars of Western aircraft

up through 10,000 megacycles, and possibly in the higher frequencies. We estimate that toward the end of this decade, Soviet equipment will be able to produce signals for jamming any of the frequencies likely to be used by the communications, radar and navigational equipment of Western aircraft. In addition, the Soviets will probably employ electronic deception techniques, such as the simulation of Western navigational aids.

VII. SOVIET CONCEPTS AFFECTING FUTURE STRATEGIC DEFENSES

27. The massive deployment of air defenses over many years indicates the high priority that the Soviets have assigned to the strategic defense mission. The general Soviet concept has been to build a defense in depth for their major centers of population and national power. In addition, they have exhibited a tendency to deploy defensive systems having some capability against a portion of the threat, rather than to wait until more effective defenses can be developed. The expenditure of resources on strategic defenses has been very large; in recent years it has amounted to about one-fifth of the expenditures which we can attribute to the major military missions.

28. The foregoing generalizations are well-supported by the various developments summarized in preceding sections of this paper. In addition to those developments, we believe that the Soviets have been working actively on other new systems for strategic defense. The present state of our evidence and analysis is such that we are not able to estimate with confidence the precise nature of much of this work. However, some perspective on Soviet thinking about requirements for new strategic defense systems is available from classified military literature of recent years.

Long-Range SAM Systems

29. Some of the articles published in secret Soviet military journals during the early 1960s dealt with the advantages of developing a long-range SAM system to defend against bombers and air-to-surface missiles (ASMs). Marshal Biryuzov, then commander-in-chief of the PVO Strany, was cited as recommending that long-range antiaircraft missiles be deployed in "zonal" defense patterns to protect the key industrial regions of the USSR. In commenting on Marshal Biryuzov's recommendation, the Soviet officer who cited him went on to state that the SAM defenses of the USSR should consist of "boundary groupings" of long-range missiles to screen the approaches to vital regions and "point groupings" of short-range missiles to defend important targets in the interior.

Anti-Ballistic Missile (ABM) Systems

30. The Soviets have expressed a growing concern for the threat posed by Western ballistic missiles, especially since the advent of the US ICBM and Polaris forces. Articles appearing in the classified Soviet military literature during 1961 argued that an ABM system to defend against strategic missiles should be capable of performing intercepts at high altitudes and long ranges

from the target areas. In those few articles discussing ballistic missile defense of which we are cognizant, the most practical method of destroying an incoming ballistic missile was said to be exoatmospheric intercept, i.e., intercept prior to the warhead's entry into the dense layers of the atmosphere. One Soviet general asserted that minimum intercept altitudes against ICBMs and IRBMs should be from 20 to 45 n.m., depending on the yield of the enemy warhead. Another Soviet general observed that it would be necessary to have antimissile missiles (AMMs) capable of ranges on the order of 110-165 n.m. and altitudes of not less than 55-110 n.m.

Systems with Dual Roles

31. The Soviets have also expressed interest in the possibility of developing missile systems which could be employed against both aerodynamic vehicles and ballistic missiles. Some officers, according to classified Soviet military articles, believed that the SA-2 missile could be modified for use against tactical ballistic missiles. In addition, the Soviets have repeatedly referred to the Griffon missile (first displayed in 1963) as a weapon capable of being employed against "all modern means of aerial and space attack," which suggests that this missile was originally intended to serve as both a SAM and an AMM.

VIII. RESEARCH AND DEVELOPMENT OF DEFENSIVE MISSILE SYSTEMS

32. The development of Soviet defensive weapon systems has been concentrated at two test ranges, Kapustin Yar and Sary Shagan. The activities on defensive systems at Kapustin Yar began in the early 1950s; to the best of our knowledge, these activities have been directed toward the development and deployment of SAM systems and for training. Sary Shagan has served primarily as an ABM development center, although it has also supported other missile and space programs and work on SAM systems has been conducted there.

Surface-to-Air Missiles

33. We have no specific evidence of any SAM system being tested beyond the SA-1, 2, and 3. However, some new SAMs (e.g., the Ganef tactical missile) have appeared in Soviet parades, and they may already be in the early stages of deployment. We have therefore thoroughly examined our ability to detect and identify the development of SAM systems, especially a long-range SAM system, and we have concluded that such systems could have been developed and tested without our knowledge.

Anti-Missile Missiles

34. The Soviets are continuing with their extensive R&D effort, begun about eight years ago, to develop defenses against ballistic missiles. In the past two years, there has been evidence of a number of changes in the Soviet ABM development program. These changes point to a new phase or phases, the

significance of which we cannot determine. But they suggest that the Soviets were testing new or modified system components, and that the new phase of the program was encountering some problems.

35. We believe it would be technically feasible for the Soviets to simulate an ICBM intercept at Sary Shagan. However, we cannot determine whether they have made any attempt to create ICBM re-entry angles or velocities during any of the tests. We have no evidence that the Soviets have conducted tests involving the use of decoys, multiple warheads, or other penetration techniques at Sary Shagan, and we think it unlikely.

36. Taken at face value, the evidence indicates a concentration on the problem of intercepting medium-range missiles. The Soviets have not attempted intercepts against ICBMs, but they have, of course, obtained considerable data on ICBM re-entry characteristics from their many ICBM tests. We believe that the Soviets have concluded that the problem of intercepting ICBMs is not significantly different from that of intercepting medium-range missiles, except that greater radar ranges are required for the acquisition and tracking of an ICBM.

Radar Development and Deployment

37. An important part of the R&D work at Sary Shagan has been the development of large radars, the Hen Roost and Hen House, which we believe were ready for initial testing in about 1961. [ ] The general configuration of these radars [ ] point to Soviet development of radars which scan their beams electronically rather than by physical movement of the antenna. Large radars employing this principle are particularly applicable to ballistic missile early warning, to long-range acquisition and early target tracking of ballistic missiles, and to detection and tracking of satellites. We believe that a number of these large radars are under construction in the USSR.

38. We believe two Hen House-type radars are now under construction on the Kola Peninsula. These radars probably will serve as ballistic missile early warning radars, but they could perform a space surveillance function as well. They could provide warning of US ICBMs directed toward western USSR—for example, 15 minutes in the case of Moscow. Additional radars in other locations would be required to provide similar warning of missile strikes against other target areas in the USSR. We have no evidence of the construction of radars suitably located for this purpose, but we estimate that the Soviets eventually will extend their ballistic missile early warning coverage. We believe that the Soviets require about two or three years to construct radars of this type in the field; the ones in the Kola Peninsula will probably be in operation in 1965.

39. Another large radar (Dog House), now under construction near Moscow, is quite different in configuration from those discussed above. It, too, will probably employ the electronic scanning principle. It may be part of an ABM system, but it could serve as a satellite tracking radar.

IX. RECENT STRATEGIC DEFENSE MISSILES

40. *The Griffon missile* is described by the Soviets as a "pilotless interceptor" which can be employed against "all modern means of aerial and space attack," implying a capability against ballistic missiles. Several months ago, the Soviets showed a TV film clip in which a missile of Griffon's general appearance was portrayed in an AMM role. We believe the Griffon was designed in the late 1950s, when the Soviets may have been seeking to develop a weapon system which could be used against both aircraft and missiles. Our analysis indicates that Griffon has a capability for intercepts at altitudes of up to about 22 n.m. (i.e., within the atmosphere) against an unsophisticated ballistic missile threat, and that it has long-range, high altitude capabilities in an antiaircraft role. We believe that the Griffon missile was developed for use at the large complexes which the Soviets have been constructing at Leningrad since the winter of 1960-1961. (See later paragraphs.)

Missile-in-the-Canister

41. In the 7 November 1964 parade in Moscow, the Soviets displayed what they described as an antimissile missile capable of destroying ballistic missiles "at great distances" from their targets. Preliminary analysis of parade photography leads us to accept an AMM role for this missile. From its size and what can be seen of its booster engines, we think that it is likely to employ a large warhead and to be designed to perform exoatmospheric intercepts. Very preliminary calculations indicate that the missile-in-the-canister may be able to accomplish intercepts at altitudes of a few hundred miles and at ranges of several hundred miles from its launch point, carrying a warhead in the megaton range. Such a missile could also be used in an antisatellite role.

42. Some new AMM may have been tested initially at Sary Shagan as early as the end of 1962. There is some chance that the Soviets could have conducted propulsion or component testing of an exoatmospheric system, but a test program involving more than a few AMM firings would probably have been detected. All things considered, we believe that the Soviets have probably not conducted many AMM firings to exoatmospheric altitudes, and that they have probably not attempted full system tests involving interceptions at these altitudes.

43. Our evidence shows that the Soviets approach the testing of missile systems with a strong presumption that the tests will be successful and that the system will be deployed. In fact, we have observed initial operational deployment of certain missile systems at about the same time as test firings began. However, the Soviets have also displayed a proclivity for conducting full system tests prior to proceeding with wide-scale deployment of a new system. We therefore

believe that the Soviets are likely to carry out system tests before committing themselves to a large-scale ABM deployment program.

44. We are unable to determine how the missile-in-the-canister is to be employed. It could be intended as the AMM in a system to be deployed in the vicinity of critical targets, such as Moscow. It might be employed in a perimeter or area defense system designed to protect large areas, such as the western urban-industrial region of the USSR. Conceivably, a missile of this type could be employed in both these ways. The kill mechanism could be designed to take advantage of the exoatmospheric effects of large-yield warheads to destroy incoming nosecones, even though accompanied by penetration aids, i.e., chaff, decoys, etc., in order to reduce the problems of discrimination.

] may imply that the USSR has developed an AMM designed to achieve a kill with the X-ray pulse of a nuclear burst.

45. A system of the foregoing type would differ in important respects from any US ABM system currently under development. Although it would have certain disadvantages, it might be attractive to the Soviets, in part because it might be more compatible with their technical capabilities than a system depending on highly sophisticated discrimination techniques.

X. RECENT DEFENSIVE DEPLOYMENT ACTIVITIES

Leningrad

46. Construction of three new defensive complexes was begun at Leningrad in the winter of 1960-1961. While our evidence has never been adequate to make a firm judgment about the function of the Leningrad facilities, we have estimated for the past several years that they probably comprised an ABM system which would be capable of engaging both IRBMs and ICBMs. Last year we estimated that the Leningrad system might have a capability against a small number of re-entering objects arriving at about the same time (i.e., either more than one missile or a missile with a small number of decoys), but that it would probably have little capability against saturation attacks or sophisticated penetration techniques.[8]

47. We believe that the Leningrad system was originally designed to have a capability against ballistic missiles, and perhaps against aerodynamic vehicles as well, but that the initial design has been changed. We cannot determine the nature of this change, nor can we determine whether it was caused by serious technical difficulties, the realization that the system was vulnerable to penetration aids, or important new developments in the state-of-the-art. There are similarities between new construction at one of the Leningrad com-

[8] Memorandum to Holders of NIE 11-3-62, "Soviet Bloc Air and Missile Defense Capabilities through mid-1967," dated 20 November 1963, TOP SECRET.

plexes and recently discovered defensive complexes under construction at Tallin and Cherepovets in northwestern USSR. (See later paragraphs.) In light of these similarities, at least these three complexes may now be intended for the deployment of the same defensive system. However, we are unable to associate the new complexes with any systems equipment, and any explanation for the mission of these complexes and for the modifications at Leningrad is open to some doubt.

Tallin and Cherepovets

48. We know of no installations in the vicinity of Tallin and Cherepovets which would call for this selection as early sites for an ABM system or even for a new SAM system. In order to function as part of an area ABM defense for the western urban-industrial region, the complexes at Tallin and Cherepovets would need to employ a missile with long-range, exoatmospheric capabilities and a compatible acquisition radar. Using a long-range AMM, complexes at these locations could defend against both ICBMs and Polaris missiles on trajectories towards Moscow or other key targets in the western region. To defend Moscow from these locations, intercepts would have to be performed at altitudes of 50 to 200 n.m.

49. These complexes, however, could be intended to serve in a SAM role. If so, we believe they would be for a long-range system, and that they may be the start of a barrier to screen a principal route of US bombers toward the industrial centers of western USSR. The missile used by such a system could be the Griffon or some other missile not yet identified. If used with appropriate guidance equipment, the Griffon would probably be effective to ranges on the order of 100 n.m. against aerodynamic vehicles at medium and high altitudes.

50. Thus, there is some support for the belief that the complexes are for a SAM system to defend against aerodynamic vehicles. On the other hand, we have noted intensive Soviet research on missile defenses for several years and indications that the USSR has been working toward new and different ABM capabilities. In light of this factor and some of the foregoing considerations, we think there are also persuasive reasons for believing that these complexes are related to missile defense. However, any judgment at this time on their mission is in our view premature.

Moscow

51. We have observed at Moscow three developments which may indicate ABM deployment there. Southwest of the city, the Soviets are constructing a large radar (Dog House) having the shape of an inverted V. The radar is well over 300 feet high and about 400 feet wide. Construction probably was begun early in 1963. We know of no prototype for this radar; it probably evolved from developmental work at Sary Shagan and probably employs the electronic scanning principle. Because of its size, the apparent orientation of one face to scan the ICBM threat corridor, and its proximity to other construc-

tion which may be ABM related, we think that the radar could serve as a long-range acquisition and early target tracking facility for an ABM system. It is also possible, however, that it will serve as a satellite tracking radar and bears no relation to ABM defense.

52. During the past year the Soviets have continued work on probable electronics facilities located at four of the outer ring SA-1 sites at Moscow. Although we believe that these facilities are intended to serve some defensive function, we cannot determine whether this function is connected with ballistic missile defense or defense against aerodynamic vehicles.

53. In addition, the Soviets have begun to modify many of the SA-1 sites during recent months. In some cases, large new revetments are apparent. A consistent pattern has not yet emerged, but some of the revetments are big enough to accommodate very large missiles. This activity may indicate that the Soviets intend to utilize the SA-1 sites as launch positions for AMMs. However, it also is possible that the activity represents a modification of Moscow's SAM defenses.

54. Thus we have observed under construction at Moscow what may be three key elements of an ABM system. The large radar could be the acquisition and early target tracking element, the facilities at the outer-ring SA-1 sites could serve as the final target tracking and missile guidance element, and the SA-1 sites could be used as the AMM launch positions for the system. However, the activities we have observed thus far may not be related to each other, and some of them may represent improvements in Moscow's defense against aerodynamic vehicles or serve a space function. Also, the missile to be employed is a major unknown; the missile-in-the-canister could be used at Moscow to conduct exoatmospheric intercepts of ballistic missiles, perhaps at distances of several hundreds of miles from the city. In sum, we continue to believe that the Soviets may now be deploying ABM defenses at Moscow, but we do not yet understand how the installations we have observed would function as an ABM system.

XI. PROSPECTS FOR SOVIET STRATEGIC DEFENSE

Air Defense

55. The combination of area and point defenses provided by the USSR's present force of interceptors and short-range SAM systems affords a good defense for major target areas against medium and high altitude bomber attacks. However, the air defense system has limited low altitude capabilities, and special difficulties are posed by Western supersonic aircraft and ASMs. We believe that a major Soviet effort during the remainder of this decade will be focused on meeting these particular problems. Moreover, in light of the continuing Western air threat and the high priority the USSR assigns to strategic defense, we anticipate a variety of Soviet measures to reduce the changes that aerodynamic vehicles of any type can penetrate to key targets.

56. Over the next few years, the Soviets will extend their networks of modern EW and GCI radars and semiautomatic air defense control systems, and they will introduce more advanced interceptor weapon systems. These developments will upgrade Soviet air defenses in general, and some of them will be applicable to the problem of low-altitude defense. The Soviets will also seek to improve their low-altitude capabilities probably by modifying their widely deployed SA-2 systems, and by extending somewhat their present limited deployment of systems designed specifically for low-altitude defense. Finally, if the developments at Tallin, Cherepovets, and Leningrad are for a new long-range SAM system then the Soviets may have begun to deploy such a system in a barrier across a likely bomber approach route to the urban-industrial region of western USSR. The initial complexes for such a system could be operational within the coming year.

57. Although we are uncertain about whether a new SAM system is to become operational, we believe that improvements in the Soviet air defense system over the next few years will make progressively more difficult successful penetration by manned bombers to major target areas. Successful penetration by manned bombers will require increasingly sophisticated forms of attack. Soviet air defense capabilities can be degraded by the increasingly complex forms of attack which the West will be able to employ, including air-launched missiles, penetration tactics, electronic countermeasures, and low-altitude attack. Despite these limitations of their air defense system, the Soviets would expect to destroy a number of the attackers. We doubt, however, that they would be confident that they could reduce the weight of attack to a point where the resulting damage to the USSR would be acceptable.

Ballistic Missile Defense

58. There are critical uncertainties in our knowledge of the present status of Soviet R&D and deployment in the ABM field. At this point in time, we can make no confident estimate about the future prospects for Soviet defense against strategic ballistic missiles. From the evidence now available, however, certain general conclusions can be drawn:

—first, the Soviet R&D effort has been extensive and of long duration, and the USSR several years ago probably solved the technical problem of intercepting ballistic targets arriving singly or in small numbers;

—second, some initial ABM deployment activity was probably begun as long ago as 1960, but both the deployment and R&D programs were evidently interrupted and modified;

—third, the magnitude of R&D and the probable early deployment activity point to a strong Soviet desire to obtain ABM defenses rapidly;

—fourth, R&D continues, a new AMM has appeared, and some additional deployment activity may now be underway, but the USSR does not have any operational defenses against strategic ballistic missiles today.

59. Much of our evidence indicates that the USSR has been exploring methods of ABM defense which differ in important respects from those now favored by the US. Low frequency radars may play an important role in the Soviet program. An early Soviet effort may have involved a missile designed to have dual capabilities against ballistic and aerodynamic vehicles. The missile most recently displayed is probably designed to conduct exoatmospheric intercepts at considerable ranges, using a large nuclear warhead to achieve its kill.

60. We cannot determine whether any of the deployment we have noted since the ABM program was modified is in fact related to ABM defenses. It could be explained in terms of improved SAM defenses, a ballistic missile early warning system, and a space surveillance system. Thus it is possible that the Soviets have at least temporarily abandoned any ABM deployment efforts. At the other extreme, it is possible that the recent activity includes two simultaneous ABM deployment programs: one a defense of Moscow, and the other an area defense of the western urban-industrial region. If ABM deployment activity is now underway at either Moscow or the other locations we have noted, the USSR is likely to have some initial strategic ABM defenses operational within the next two years or so.

61. Limited deployment activity, especially at Moscow, could be a special, highest-priority effort to defend the Soviet capital with an early and still unproved system. But widespread ABM deployment activity, whenever it occurred, would imply that the Soviets consider their ABM systems good enough to justify extraordinarily large new expenditures. It would indicate that the Soviets had achieved excellent R&D successes and, perhaps, that they had taken high-risk production and deployment decisions. We cannot exclude this possibility, but our evidence suggests that the Soviets have been proceeding cautiously since they modified their program.

62. In considering whether to provide ABM defenses for many of their urban-industrial centers and other targets, the Soviet leaders will have to weigh the great cost of such an effort against the likely effectiveness of the ABM systems available. Area defenses might offer considerable savings over point defenses, but we cannot be sure of this and in any event a major commitment of resources would be required. The Soviets may defer widespread deployment pending further R&D work on existing systems, or in the hope of achieving better systems at a later date. They might even decide that the cost of large-scale ABM deployment would not be commensurate with the protection it could offer against anticipated Western strike capabilities. We are certain that the Soviets will push ahead with their R&D effort, but we cannot forecast whether or when they will achieve ABM systems with capabilities and costs justifying widespread deployment.

XII. ANTISATELLITE CAPABILITIES

63. The evidence is insufficient for us to estimate with confidence whether the Soviets are now developing weapon systems for defense against space vehicles, but we think that they almost certainly are investigating the feasibility of pro-

ducing such systems. The large radars, such as Hen House, which we believe to be now under construction in the USSR and the Dog House radar near Moscow, are candidates for use in space surveillance and tracking. This may not be the assigned or primary role for some of these radars—a few, for example, will probably perform a ballistic missile early warning function. However, we believe that some or all of these radars will be linked together as a space surveillance system. Such a system would enable the Soviets to observe and track satellites and other orbiting objects during most of the passes over the USSR. It would probably also be capable of predicting the orbits and positions of non-Soviet satellites and space vehicles with a high degree of accuracy after several crossings of the USSR.

64. Most of the large radars believed to be now under construction will probably become operational in 1966; all will probably be operational in 1967. We estimate that, when completed, the system using these radars will have a capability considerably in excess of that required merely to detect the passage of US space vehicles. In addition, the USSR already has the capacity to track its own satellites, utilizing transmissions from them, with greater accuracy than would be provided by the new system. Considering these factors, we think the chances are better than even that the Soviets intend to provide themselves, not only with a space surveillance system, but with an antisatellite capability as well.[9]

65. The kill mechanism which could be employed by an antisatellite system depends on the capabilities of its tracking radars and the accuracy and maneuverability of the interceptor missile it employs. If the new radars are coupled with existing types of missiles in an antisatellite system, the system would probably have to employ a nuclear warhead to achieve a kill. Non-nuclear kill of a satellite would require a missile which would combine an accurate guidance system with an exoatmospheric maneuver capability. We believe that the Soviets could develop such a missile in about two years after the initiation of flight tests. We have no evidence that the Soviets are as yet conducting such tests.

66. The Soviets could probably develop a capability against satellites in near-earth orbits by modifying existing ballistic missiles and radars. Such a capability could be acquired within a few months of a decision to do so, but we have no

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[9] The Director of Intelligence and Research, Department of State, believes that on the basis of available evidence, this affirmative judgment is premature. While he does not exclude the antisatellite function as a possibility, present evidence does not persuade him that the Soviets intend to develop and deploy within the next two years and at great cost an extremely complex antisatellite system. The Soviets, as noted in Paragraph 66, could probably develop a limited antisatellite capability by modifying existing missiles and radars within a few months after deciding to do so.

The Director of INR notes that space tracking problems in future years will be made vastly more complicated by an ever increasing number of space experiments, using larger and more complex components, which will be carried out by a growing number of countries. The Soviets are likely to be interested in developing a more sophisticated space surveillance capability to prepare for this eventuality.

evidence that they have made such a decision. We believe that, to achieve a successful intercept by using such a technique, the Soviets would need to use a nuclear warhead.

XIII. CIVIL DEFENSE

67. The Soviets have long recognized the value of civil defense as a means of preparing their nation to withstand and recover from a full-scale strategic attack. Compulsory public training courses, initiated in 1955, are being continued. We believe, however, that the Soviets have concluded it is infeasible to devise and implement shelter construction programs which would effectively protect the bulk of the urban population in the event of a large-scale nuclear attack. Since 1962, Soviet civil defense plans have emphasized the concept of urban evacuation. However, we estimate that two to three days would be required to conduct the evacuation of the population from the major Soviet cities. Thus, mass evacuation is likely to be feasible only if a large-scale nuclear exchange were preceded by an alert period. The Soviet civil defense system is now emphasizing mobility of operational units for evacuation and mutual aid, and new units are being formed in the countryside to aid cities after attack.

68. Although we believe that the Soviets have severely curtailed their urban shelter construction program, they probably have made provisions for including shelters in the schools, hospitals, and perhaps certain industrial facilities now being constructed. We calculate that there are some 22 to 26 million shelter spaces available for the urban population, or roughly one space for every four city-dwellers. The Soviets have, in addition, encouraged the rural population to prepare their own makeshift shelters, such as root cellars, for protection against fallout. The Soviet leadership probably does not expect that the present civil defense program will provide adequate protection for more than a small portion of the population. We have no evidence to indicate that the Soviets are planning a resumption of a major shelter construction program.

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ANNEX A

TABLES

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Table 1 *

ESTIMATED CHARACTERISTICS AND PERFORMANCE OF SOVIET INTERCEPTOR SYSTEMS

System	Max. Speed At Optimum Altitude [a] (KTS.)	Combat Ceiling (Ft.) [a] [b]	Optimum Combat Rad. [a] [c] (N.M.)	All-Weather Capability	Radar Range Search/Track (N.M.)	Main Armament	Attack Capability	Eff. Attack Range (N.M.)
FAGOT	585	51,000	575	no	—	Guns/Rockets	Tail Attack	0.5
FRESCO A	605	53,400	540	no	—	Guns/Rockets	Tail Attack	0.5
FRESCO B	605	53,400	540	no	—	Guns/Rockets	Tail Attack	0.5
FRESCO C	620	54,500	510	no	2/1 [d]	Guns/Rockets	Tail Attack	0.5
FRESCO D	620	54,500	510	yes	6/1	AAMs	Tail Attack	2-3
FRESCO E	605	53,400	540	yes	6/1	AAMs	Tail Attack	2-3
FARMER A	760	54,500	520	no	2/1 [d]	Guns/Rockets	Tail Attack	0.5
FARMER B	760	54,500	520	yes	8/4	Guns	Tail Attack	0.5
FARMER C	760	54,500	520	no	2/1 [d]	Guns/Rockets	Tail Attack	0.5
FARMER D	760	54,500	520	no	2/1 [d]	Guns/Rockets	Tail Attack	0.5
FARMER E	750	54,900	520	yes	8/5	AAMs	Tail Attack	3-4
FLASHLIGHT	610	49,400	575	yes	12/8	Guns	Tail Attack	0.5
FISHPOT	1,205	60,000	540	yes	12/8	AAMs	Tail Attack	3-4
FITTER	1,205	58,000	580	no	4/3 [d]	AAMs	Tail Attack	5-6
FISHBED C	1,150	61,000	510	no	4/3 [d]	AAMs	Tail Attack	5-6
FISHBED D	1,150	61,000	510	yes	12/8	AAMs	Tail Attack	5-6
FISHBED E	1,150	61,000	510	no	4/3 [d]	AAMs	Tail Attack	5-6
FIREBAR	820 *	54,000	500	yes	34/25	AAMs	Tail Attack	7
FIDDLER	1,175	53,000	1,060	yes	40/30	AAMs	Universal Attack	Tail 10, Nose 17

See footnotes at end of table.

Table 1 * (*Continued*)

System	Max. Speed At Optimum Altitude [a] (KTS.)	Combat Ceiling (Ft.) [a b]	Optimum Combat Rad. [a c] (N.M.)	All-Weather Capability	Radar Range Search/Track (N.M.)	Main Armament	Attack Capability	Eff. Attack Range (N.M.)
Improved All-Weather	1,435	65,000	300	yes	20-25/15	AAMs	Tail Attack	9
Advanced All-Weather	1,750	70,000	500	yes	80-100/40-50	AAMs	Universal Attack	?

[a] Characteristics have been calculated independently and cannot all be achieved on the same flight profile.

[b] Soviet Mach 2 interceptors equipped with search/track radars have the capability to make intercepts, with limited effectiveness, in dynamic climb against subsonic targets at altitudes on the order of 70,000 feet when under close GCI direction.

[c] With external fuel.

[d] Search and track performances denote ranges only.

[e] There is some evidence now under study indicating that the maximum speed of the FIREBAR could be significantly higher.

* The Assistant Chief of Staff, Intelligence, USAF, notes that paragraph 16 of the estimate acknowledges the current development of "two or possibly three new interceptors." He believes that current evidence as well as future Soviet requirements make the development of three new fighters the more likely possibility. The ACS/I, USAF, would therefore substitute for the last two entries of this table, the following:

ESTIMATED CHARACTERISTICS AND PERFORMANCE OF SOVIET INTERCEPTOR SYSTEMS

System	Max. Speed at Optimum Altitude [a]	Combat Ceiling (Ft.) [a b]	Optimum Combat Rad. [a c]	All-Weather Capability	Radar Range Search/ Track (N.M.)	Main Armament	Attack Capability	Eff. Range	Attack (N.M.)
FLIPPER	1,435	65,000	330 [f]	Yes	25/18	AAM	Tail Attack		9
Improved All-Weather	1,610	70,000	400	Yes	60/50	AAM	Universal Attack	Tail	10
								Nose	11
Advanced All-Weather	1,720	70–75,000	1,000	Yes	60/50	AAM	Universal Attack		40

[f] Subsonic MACH 1 intercept radius. Radius is 60 N.M. for supersonic MACH 2.5 point intercept mission.

Table 2

ESTIMATED CHARACTERISTICS AND PERFORMANCE OF SURFACE-TO-AIR MISSILE SYSTEMS ASSIGNED TO THE PVO STRANY

System	SA-1	SA-2	SA-3
Launchers per site	60	6	4 (dual)
Maximum Operational Range (N.M.) [a]	20–25	about 25	10–15
Maximum Effective Altitude (ft.) [b]	60,000	90,000	25,000–50,000
Minimum Effective Altitude (ft.) [c]	3,000	3,000 [d]	about 1,000 [e]
Accuracy (CEP in ft.)	200	about 100	

[a] Range will vary with size, altitude, speed, and approaching direction of the target. Against subsonic targets, the ranges are as shown; against supersonic targets, the ranges decrease.

[b] The SA-1 and SA-2 systems have some effectiveness above the shown altitudes.

[c] Such factors as siting conditions and target speeds influence low-altitude capabilities.

[d] Recent evidence indicates that there are modifications which can be made to the SA-2 missile to reduce the lower altitude limitation of the system to about 1,500 feet. Additional recent data indicate that the Soviets are willing to commit missiles against targets flying considerably below 3,000 feet. At these low altitudes, the effectiveness of the system may be degraded; the low altitude limit of a given site would be affected by local terrain.

[e] We have no evidence as to the minimum effective altitude capabilities of this system.

ANNEX B

MAPS

FIGURE 1: SAM DEPLOYMENT IN THE EAST EUROPEAN WARSAW PACT COUNTRIES

FIGURE 2: SAM DEPLOYMENT IN EAST GERMANY

FIGURE 3: SA-2 AND SA-3 DEPLOYMENT IN THE USSR

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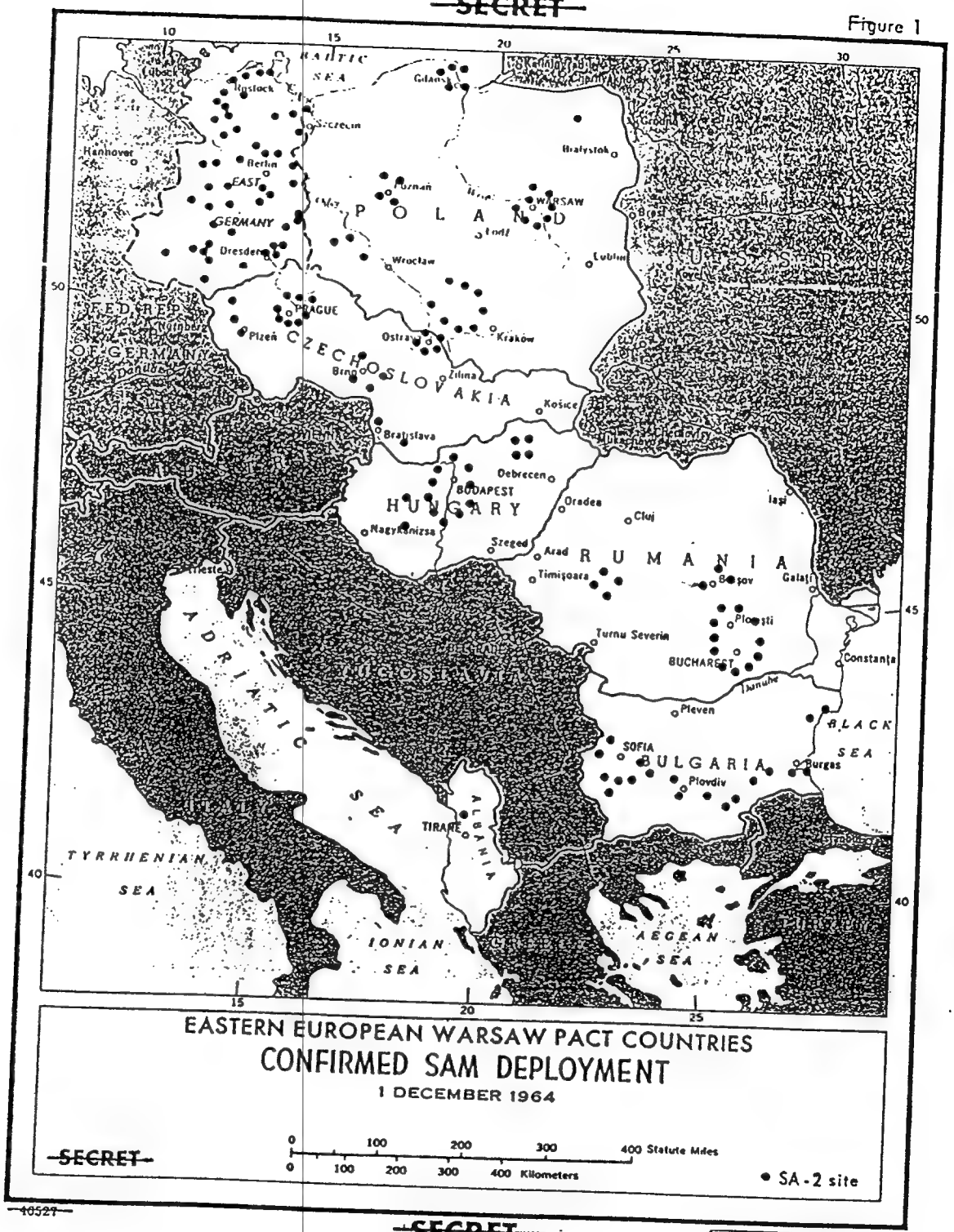
Figure 1



EASTERN EUROPEAN WARSAW PACT COUNTRIES

CONFIRMED SAM DEPLOYMENT

1 DECEMBER 1964

~~SECRET~~

0 100 200 300 400 Statute Miles

0 100 200 300 400 Kilometers

• SA-2 site

10527

~~SECRET~~

NO FOREIGN DISSEM

GROUP 1
EXCLUDED FROM AUTOMATIC DOWNGRADING AND DECLASSIFICATION

~~SECRET~~

Figure 2

EAST GERMANY

CONFIRMED SAM DEPLOYMENT

1 DECEMBER 1964

EAST GERMAN* SA-2 Site

SOVIET* SA-2 Site

~~SECRET~~

STATUTE MILES 0 100

KILOMETERS 0 100

*Probable subordination

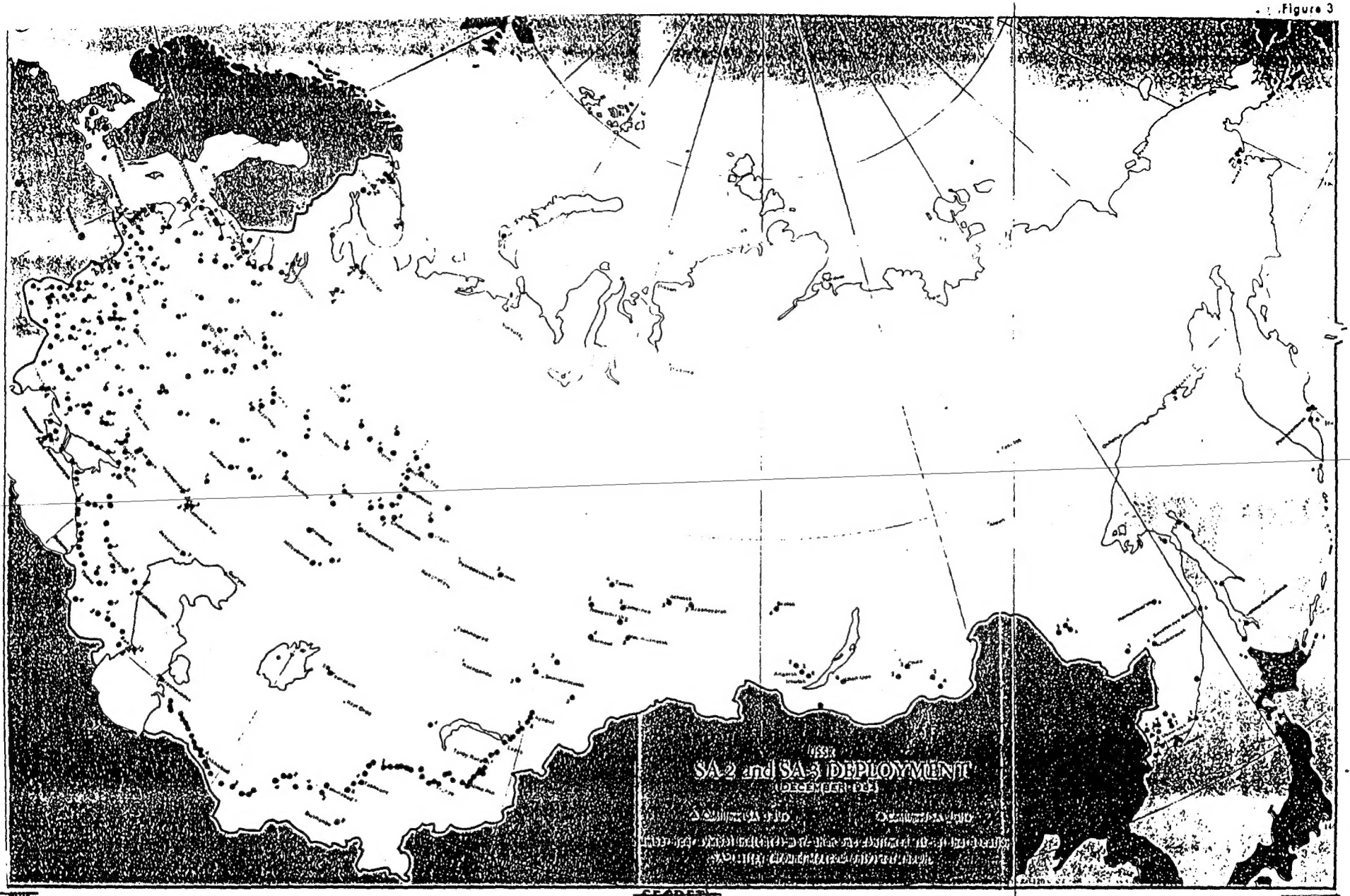
~~46638~~

~~SECRET~~

NO FOREIGN DISSEM

GROUP 1
EXCLUDED FROM AUTOMATIC DOWNGRADING AND DECLASSIFICATION

Figure 3



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